

Application Serial No. 10/603,306
Reply to Office Action of September 13, 2004

PATENT
Docket: CU-3271

Amendments To The Claims

The listing of claims presented below will replace all prior versions, and listings, of claims in the application.

Listing of claims:

1. **(Currently Amended)** A method for forming a capacitor of a semiconductor device comprising the steps of:

forming an interlayer insulating film on a semiconductor substrate formed with a bit line;

forming a contact plug in contact with the substrate within the interlayer insulating film,

forming a storage electrode of polysilicon on the interlayer insulating film in such a manner that the storage electrode comes in contact with the contact plug,

forming layers of Ta₂O₅ and Y₂O₃ one layer over the other layer in an alternating fashion on the storage electrode according to ALD (Atomic Layer Deposition) technology,

forming a dielectric film composed of a single composite film having Ta₂O₅ and Y₂O₃ of Ta₂O₅(X)Y₂O₃(1-X) on the storage electrode according to ALD (Atomic Layer Deposition) technology,

depositing a diffusion barrier film on the dielectric film, and

forming a plate electrode of polysilicon on the diffusion barrier film

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2. (Currently Amended) The method according to claim 1, wherein the step of forming the dielectric film comprises the sub-steps of:

~~repetitively depositing a Ta₂O₅ thin film and a Y₂O₃ thin film in alternation to a predetermined thickness with ALD technology,~~
~~performing low temperature annealing of the alternately deposited thin films of Ta₂O₅ and Y₂O₃ converting the deposited films to convert the thin films into a single composite film,~~
~~performing N₂O plasma annealing of the converted single composite film to remove carbon and impurities contained within the single composite film, and~~
~~performing furnace annealing of the N₂O plasma annealed single composite film to crystallize the single composite film.~~

3. (Original) The method according to claim 2, wherein the Ta₂O₅ thin film is deposited to a thickness of less than 10 Å by alternately injecting Ta(OC₂H₅)₅ source gas and H₂O reaction gas into a reactor at a temperature of 250 to 350 °C according to ALD technology.

4. (Original) The method according to claim 3, wherein inert gas is injected at a period of time between that of injecting the Ta(OC₂H₅)₅ source gas and that of

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injecting the H₂O reaction gas so as to leave no residue of the source and reaction gases.

5. (Currently Amended) The method according to claim 3, wherein each injection of the Ta(OC₂H₅)₅ source gas, the inert gas and the H₂O reaction gas is performed for 0.1 to 10 seconds.

6. (Original) The method according to claim 2, wherein the Y₂O₃ thin film is deposited to a thickness of less than 5 Å by alternately injecting yttrium source gas and H₂O reaction gas into a reactor at a temperature of 250 to 350 °C according to ALD technology.

7. (Currently Amended) The method according to claim 6, wherein inert gas is injected at a period of time between that of injecting the ytrrium source gas and that of injecting the H₂O reaction gas so as to leave no residue of the source and reaction gases.

8. (Currently Amended) The method according to claim 6, wherein each injection of the ytrrium source gas, the inert gas and the H₂O reaction gas is performed for 0.1 to 10 seconds.

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9. (Original) The method according to claim 3, wherein in the deposition of the Ta₂O₅ thin film and the Y₂O₃ thin film, O₂ or N₂O gas is injected as the reaction gas in place of H₂O.

10. (Currently Amended) The method according to claim 4, wherein any one selected from the group consisting of N₂, Ar or and He is injected as the inert gas.

11. (Currently Amended) The method according to claim 2, wherein the Ta₂O₅ thin films and the Y₂O₃ thin films are repetitively deposited in an alternating order alternation up to an overall thickness of 100 to 200 Å.

12. (Currently Amended) The method according to claim 2, wherein the deposition ratio between the Ta₂O₅ thin film and the Y₂O₃ thin film is about 80% : 20%, respectively X:(1-X).

13. (Currently Amended) The method according to claim 2, wherein the low temperature annealing is performed at a temperature in the range of 400 to 550 °C.

14. (Original) The method according to claim 2, wherein the N₂O plasma annealing is carried out in a rapid thermal annealing mode in which annealing temperature is 300 to 400 °C, annealing time is 60 to 180 seconds and N₂O gas

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flow rate is 10 to 100 sccm.

15. (Original) The method according to claim 2, wherein the furnace annealing is performed at a temperature of 600 to 850 °C for 5 to 60 minutes while N₂, O₂, or N₂O gas flowing in a furnace.

16. (Original) The method according to claim 1, wherein the diffusion barrier film is a TiN film.